

**INTERIM REPORT ON
PROGRAMMES AND POLICIES OF FLYASH UTILISATION
IN INDIA**

**PROMOTION OF MASS SCALE FLYASH UTILISATION
TOWARDS
CONSERVATION OF ENERGY & MINERAL WEALTH AND
WELFARE OF ECOLOGY & ENVIRONMENT**

**UNDER
TERI / NEDO / EPDC
ROUND TABLE CONFERENCE COMMEMORATIVE GRANT**

August 1997

**INSTITUTE FOR SOLID WASTE RESEARCH
&
ECOLOGICAL BALANCE
(INSWAREB)**



TALK ABOUT POLLUTION WITH A SOLUTION

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INTRODUCTION

India generates about 150 million tons of industrial solid wastes per annum out of which about 65% are qualified for cement and building material. Any attention to this dimension automatically answers two national issues in one go :

- * Industrial waste utilisation towards pollution abatement with conservation of mineral wealth;
- * Enlargement of cement and building material production with improved durability at controlled costs.

The principal industrial solid waste generation (per annum) is as follows :

1.	Flyash	...	70 million tons
2.	Blast Furnace Slag	...	10 million tons
3.	Lime sludge	...	5 million tons
4.	Red mud	...	5 million tons
5.	Chemical gypsum	...	2 million tons
6.	Other miscellaneous slags, ashes, sludges, cinders etc	...	58 million tons

Institute for Solid Waste Research & Ecological Balance (INSWAREB), Visakhapatnam, has taken the task of industrial waste utilisation in this direction and involved in promoting flyash utilisation for the last 6-7 years for its voluminous output dominating the scenario. FaL-G technology, which has been accepted and practised nationwide for its down-to-earth features, proved as one of the strengths of INSWAREB. Cement chemistry is one of the active subjects pursued by INSWAREB because the latter has realised that about 65% of industrial solid wastes can be tackled, one way or the other, towards cement and cementitious building material. Through this insight, INSWAREB has realised the vacuum in the country for not tapping the potentiality of flyash as cementitious material.

With all these realisations, INSWAREB has already launched enlightenment programme at national level to educate consumers, technocrats, market forces and the policy makers of government. *Foundation for Advanced Concrete Technology (FACT)* is the subsidiary of INSWAREB, aimed to promote the knowledge of modern techniques wherein industrial byproducts such as rice husk ash, flyash and slag play dominant role.

THE ASSIGNMENT

A Round Table Conference on initiatives to promote India-Japan Cooperation for clean and efficient energy has been jointly conducted by the Tata Energy Research Institute (TERI), New Energy and Industrial Technology Development Organization (NEDO) and Electric Power Development Company (EPDC) on 25th January 1997 at TERI, New Delhi.

As a commemoration of the Round Table, two grants for research surveys have been announced on the following themes :

- Energy
- Global environment; and
- International cooperation

Under the theme of global environment, INSWAREB has responded to conduct a survey on *promotion of mass scale flyash utilisation towards conservation of energy & mineral wealth and welfare of ecology & environment.*

To concise the title, INSWAREB has also identified this survey as:

Programmes and policies of flyash utilisation in India.

APPROACH

In this background, the Award of the Survey proved as an opportunity to INSWAREB not only to discuss the data available on hand but also to enrich and update the same through additional survey.

INSWAREB has begun the survey with the *Special Lecture* of Prof PK Mehta, Professor Emeritus in Civil Engineering, University of California, Berkeley (USA) at Visakhapatnam in March 1997 involving faculty, industry, architects, builders etc to get enriched with the happenings in the West and to know the views of Indian brethren for the lapses in flyash utilisation. This event has helped in articulating various strategies and technical debates to awaken the government about its accountability.

INSWAREB has undertaken survey of Hyderabad in May, Delhi, Haryana and Punjab in July 1997. It has conducted interviews of personalities as cited in Annexure I.

Similar surveys would be conducted at the East (Calcutta and Orissa), West (Mumbai and Baroda) and South (Bangalore, Mangalore and Madras) in the next couple of months to come out with first hand information on the happenings of flyash front at national level.

Notwithstanding the survey report under the scope of this assignment, INSWAREB has taken additional initiative to prepare a video document in order to concise the total findings in about 45-60 minutes of video presentation. No doubt, this step costs exorbitantly high to INSWAREB but it feels that presentation of such video document would impart first hand information in more picturesque way.

In order to break the monotony of technical presentation in a long video session, subject to budgetary provisions, there is a proposal to break the total video coverage into capsules of 15-20 minutes each with the following titles :

- * **The success story of Ropar thermal power plant :**
An inspiration to other State Governments for promoting flyash utilisation;
- * **Drona FaL-G Bricks :**
A rehabilitation story for ex-servicemen;
- * **Need to shift from clay to flyash :**
The role of judicial activism;
- * **Programmes and policies of flyash utilisation:**
The National Flyash Policy;
- * **Portland Pozzolana Cement (PPC) :**
For durability of concrete and promotion of flyash.

The ensuing Chapters discuss prima-facially the vital information and basic logics thereon. The final report would contain all other supporting documents pertaining to codes and practices, policies of government on utilisation of flyash.

THE FLYASH

NATIONAL SCENARIO

India, with its dependence on coal for about 65% of total power generation, is bound to effect the environment with simultaneous flyash generation. With the projects in pipeline, it is expected that the country would generate about 110 million tpa of flyash by 2010.

Except lignite coal at Neyveli Lignite Corporation (NLC), the remaining coal used by all other thermal plants throughout the country is that of bituminous, facilitating to generate Class F flyash. Lignite coal gives Class C flyash.

The Report gives a graphic presentation of power and flyash generation in India with details on future scope.

TECHNICAL CONSIDERATIONS

Till 70s, there was no environmental concern in power plants on account of which the combustion efficiencies and the ash collection practices were marginal. Thereby, the quality of flyash generated was also that of inferior standards. From 80s, the concern for environment has improved. In result, opportunities were brightened up for obtaining qualitative flyash through efficient combustion systems as well as ash collection systems such as Electrostatic Precipitators (ESP) and Bag Filters. For example, the multiple fields of ESP installed to collect finest particulates of flyash, in the concern for minimising the SPM in flue gases, facilitate to collect flyash at different finenesses and reactivities. This development is rather a boon for flyash utilisation, more so to building materials and cement industry. But, the unfortunate reality is that neither the brick industry nor cement industry has taken advantage of the situation. The Report conducts a detailed techno-administrative investigation and identifies the factors for this malady.

Class F flyashes are technically more qualified to be admixed with Ordinary Portland Cement (OPC) either for production of PPC [BIS:1489(1)-1991] or masonry cement [BIS:3466-1988]. Various cementitious blends manufactured in Western countries use as high as 53% flyash if such ash is available in Class F. Though Class C flyash is economical in one sense, which can minimise the demand of lime, for the preparation of blended cements or concretes Class C ash is proven to be inconsistent in comparison to Class F. The reason is that Class C flyash releases profuse heat of hydration by which stiffening takes place without allowing time for workability. Hence, with due monitoring and retardation, Class C can be put to use for precast elements taking advantage of savings on lime input. However, on rheological grounds and stoichiometry, Class F ash is availed on priority in Western countries for the production of blended cements. But, the popular belief is that Class C flyash is superior for having enriched with lime in comparison to Class F which is not true. Each flyash has to be handled, independent to its characteristics, depending on the end product needs and techno-economic considerations.

Mixing of 30-35% flyash for high strength concretes to construct premium structures like under-sea tunnels, launch pads etc is a common feature in the West. PPC is preferred for its durability and longevity by about 2-3 times over conventional cement (OPC), thereby, by using PPC, the Western countries are not only improving the life of their structures but conserving energy and mineral wealth to the extent of flyash blend in cement. India, in spite of bestowed with Class F flyash, has not only failed to take advantage of such virtuous availability but miserably lagging behind even to impart basic education and awareness in faculty, administration and policy makers. In this context, it is surprising to learn that the curricula of engineering colleges does not contain information on cementitious byproducts and their role in advanced concrete technology.

Hence, in a way, by not utilising flyash towards PPC, the country is losing about Rs 2000 per ton or a colossal amount of Rs 8,000 crores a year with reference to cement grade flyash.

While the government is concerned, right at the Cabinet level, for flyash generation and accumulation, it is surprising that the potentiality of flyash and the techno-economic attractions have not been realised in India even by taking advantage of precedence and field level testimonies of Western world. The Report discusses details of this unfortunate situation but presently and promptly holds the national institutes, who work as the think-tank of government for policy making on technological issues, as majorly responsible. At least now, it is hightime for government of India to awaken to the realities lest the judiciary takes the lead in sensitising the government. The recent judgment of Supreme Court banning clay brick and directing Delhi Administration to rehabilitate the workforce through flyash based industries is a striking example in this context.

FLYASH UTILISATION

AS BRICK/BLOCK

Clay brick is the age old product established since millennia enjoying absolute confidence of consumers. There are standing examples where clay brick was used not only for housing but also in infrastructure applications like canal linings, irrigation works, pavements etc. The credit goes to the quality of brick that was produced in older ages. With passage of time, deterioration in clay quality on one side and escalation in fuel costs on the other forced the brick industry to compromise on quality of brick in addition to insufficient sintering practices.

But, rapidity in urban development and surmounted construction needs compelled the government and consumers to compromise with quality of clay bricks as available.

In this background, an alternate walling material with improved engineering properties is the need of the day.

According to one study, the urban market for clay brick is 60 billions and the national level demand is 180 billions, depleting the top soil by 180 and 540 million tons respectively.

Considering 25% penetration of flyash bricks at national level, it can be envisaged to consume 30-45 million tons of ash every year.

As a matter of fact, in a country like India, where 70 million tpa of flyash generation is the reality that would reach 110-120 million tpa by 2010, allowing the brick industry to tap clay is a social crime, at least in the regions where flyash is available. In other words, in pockets where the clay quality is poor (some parts of Andhra Pradesh, Maharashtra, Tamilnadu etc), allowing the production of sub-standard clay brick is not desirable. In pockets where clay quality is good (such as Uttar Pradesh, Punjab,

Haryana etc), allowing such good quality clay for production of brick instead of conserving for agriculture is equally a reprehensible issue. But, all these undesirable practices were allowed to be continued in the absence of any competitive technologies for production of flyash bricks.

Even at the brink of 21st century, 90% of clay brick industry in India is confined to cottage and small scale sector with simple production practices. While enormous employment is one criterion of this sector, consistent to rural oriented economy of India, controlling the brick price to minimum possible level is another plausible feature. In this context, a technological substitute is looked for with parallel scale of operation to ensure similar socio-economic fabric.

However, the known technology for 'flyash cast elements' is through autoclave treatment which makes the plant prohibitively costly. In result, servicing cost of finance alone is almost parallel to the clay brick cost, leaving aside the cost factors of utilities and administrative overheads. It is for this fact, the plants those have come up in India over the last two decades based on autoclave technology could not survive. The plant of M/s Ballarpur Industries Ltd near Faridabad in Haryana is the latest example of this defeat. The exorbitant price of high-tech flyash brick over that of down-to-earth clay brick production cost is the predominant reason.

ROLE OF FaL-G TECHNOLOGY

FaL-G is not a brand name but a product name, christened to the mix for easy identification of its ingredients, flyash (Fa), lime (L) and gypsum (G).

- Flyash-lime reactions are more active in tropical temperatures.
- The rheology and strength pattern of flyash-lime mixes get multifold boost in association with gypsum.

Based on the features of the above two factors, FaL-G technology has been developed by INSWAREB. This technology has facilitated to avoid heavy duty press as well as autoclave. The characteristic superior strength of FaL-G facilitates casting of the product under pressure-free conditions that gains strength in normal environment with simple water curing. While the Report discusses the total techno-economic considerations of FaL-G technology, the simplicity of this technology has encouraged many clay brick manufacturers as well as tiny level technocrats to take up the production. More importantly, FaL-G brick making activity enables the absorption of total workforce engaged in brick kilns to ensure the maintenance of socio-economic fabric of the industry. This is an important issue under political considerations too in India.

In result, about 110 plants are already functional at various parts of the country and INSWAREB has owned a target of initiating not less than 10,000 plants by the next decade.

In the background of these facts, while the Supreme Court has banned clay brick in the National Capital Territory (NCT) of Delhi and directed the Delhi Administration to rehabilitate them with alternate flyash based brick technologies, FaL-G is evaluated with a sigh of relief by the administration for its absolute socio-economic role to play in rehabilitating the entrepreneurial and

labour force of clay brick industry. The report discusses the details of Supreme Court Order, its ramifications and overtones in the future scenario of walling material.

Flexibilities

Once the optimum FaL-G is established as the cementitious media, it can bind any aggregate and the synthesis of product has a lot of options, leverages and flexibilities. For example, FaL-G can bind the following aggregates independently or in combinations :

- Sand
- Crusher dust
- Cinder
- Pond ash
- Metal chips
- Rubble
- Clay

Wherever lime is in scarcity, the recent studies established that FaL-G can be practised with OPC as the source of lime without disturbing the economics. Thereby, FaL-G can be practised both in lime route and OPC route.

With all these explanations, it may be conclusively highlighted that FaL-G brick/block is a product of different inputs based on local conditions for raw material price and comparative brick price in order to allow operational flexibility in different logistics.

FaL-G, being a product devoid of either autoclaving or sintering, proves to be totally energy-free and thereby absolutely eco-friendly. The operational ease of FaL-G brick is so commanding that the product can roll out from the production line by 12th-22nd day (in summer and winter respectively) as against 35-45 days in clay brick production.

FaL-G bricks can be cast manually as simple as clay and also can be practised in different mechanisation routes including hydraulic/mechanical presses. Hence, the scale and type of operations can be oriented in manual mode, wherever employment potentiality is to be taken care, as well as in machine mode where output of huge quantities is the criterion. Thereby, FaL-G is an activity of both corporate sector as well as cottage sector and it could be put in cooperative sector also to encourage clusters of FaL-G brick plants.

FaL-G for infrastructure

With its enormous strength feasible between 200-400 kg/sq cm together with cementitious behaviour, FaL-G is useful not only as walling material but also as infrastructure product. It is for this reason, FaL-G is coined with a slogan, *cementitious virtues at clay price*. It is hoped that government of India would take advantage of this product in order to accomplish various minor irrigation and infrastructure projects by which the budget constraints could overcome on one hand and massive flyash utilisation target can be met on the other.

Studies at INSWAREB proved that high strength FaL-G bricks can be broken into coarse aggregate which yields parallel engineering properties with that of natural stone aggregate. While the erstwhile technologies for the production of flyash based aggregate summons for involvement of sintering and consumption of 800-900 K Cal of energy per kg, production of FaL-G aggregate is totally energy-free. The Report discusses the total engineering features of this approach and lays emphasis on the scope of flyash utilisation in various avenues with proven techno-economic logistics, simultaneously projecting certain accountabilities for government of India to support the mission administratively.

FLYASH AS CEMENT

The known BIS Codes for flyash based cements are as follows :

- | | | |
|------------------------------------|-----|------------------|
| 1. Portland Pozzolana Cement (PPC) | ... | BIS:1489(1)-1991 |
| 2. Masonry cement | ... | BIS:3466-1988 |

These codes cite 33 grade cement as the parent input, while deciding the dosing parameters of flyash, specifying the ultimate PPC as 33 grade. Now, through the technological advancements in cement, OPC can be manufactured with 43, 53 and 63 grades.

Thereby, two scenarios emerge :

1. If the same dosing limitations of 10-25% are observed for flyash input, it is feasible to manufacture PPC also with 43 and 53 grades.
2. If 33 grade is the final criterion for PPC, the high strength parent cement (OPC) can accommodate more flyash beyond 25% to as high as 35-40%.

For the above two features, the fine grade flyash available from 2nd field onwards of ESP is the boon. Nevertheless, 1st field flyash also is useful, subject to its fineness, with or without inter-grinding.

On the part of government, it is required :

- To make available right grade of ash to cement industry without any hassles.

- To redraft the code for PPC, on one side with higher input of OPC, and notifying the high strength grades on the other. The marketing forces and the manufacturers would decide the path that they have to follow through mutual convenience. In either case, the engineering features of the structure is not going to be hampered. On the other hand, the longevity of the structure is bound to improve.

But, the misery is that the concerned departments have no time to look into these realities nor to attend to the measures to be undertaken forthwith. The Report discusses various issues of accountability to be owned by government of India for streamlining the flyash generation and accumulation as well as to promote its use in acceptable techno-economic ways.

FLYASH AS SOIL CONDITIONER/FERTILISER/PESTICIDE

An announcement by Dr Sankar Sen, Power Minister of West Bengal on 2nd April 1992 in the State Assembly indicates that flyash has been used as fertiliser which has contributed for the increase of yield for tomato and ladies-finger. Madhya Pradesh Pollution Control Board (MPPCB) has carried out some tests and developed five plots for wheat crop cultivation. The yield from all the plots, where flyash was used, was observed to be higher.

According to Prof P Narayanaswamy, series of two research projects undertaken at the Department of Entomology, Annamalai University, have concluded that flyash has a promising future as a pesticide. Further, it has been found to be a potential carrier in the preparation of insecticide formulations. Lignite ash is used for this purpose that has been found to be a potential dust pesticide against various crop pests particularly in rice.

To draw national attention and create awareness among the farmers, public and entrepreneurs, a three day National Seminar titled '*Use of lignite flyash in agriculture*' was organised at the

Annamalai University. This drew more than 75 scientists from all over India and various kinds of flyash use in plant protection, plant nutrition, soil fertilisation, bio-fertiliser production etc were brought forth and discussed.

The meet recommended that the flyash be freed from the unwanted chemical elements like Al, Pb, Cu, As etc. Accordingly, plans are afoot to prepare *safe flyash* so as to come out with *flyash pesticides* for use in agriculture without fear.

FLYASH AS LANDFILL

Landfill with flyash may be considered as the most desperate activity to undermine its potentialities. However, billions of tons of flyash accumulated in various ash ponds throughout the country lose cementitious character and value addition features. These pond ashes can be used as landfills instead of tapping the natural earthly materials.

It is proposed to use flyash for filling of embankments on the approach roads to the Indo-Japanese Friendship Bridge at New Delhi. The bridge, a gift from Japan, is coming up parallel to the existing Nizamuddin bridge connecting Noida and Uttar Pradesh with Delhi. But, as per the Chairman of FAMTAG, Prof DV Singh, in the absence of a national code of practice for flyash utilisation in India, the proposal for field level demonstration was to take a long exercise to convince the authorities concerned for deployment of flyash. This episode highlights the need of consistent *National Flyash Policy* with detailed code of practice for flyash utilisation. While the pond ash can be tapped for landfills in order to save natural earthly materials, it is desirable that fresh and dry flyash that comes from ESP/bag filter be earmarked for value added products more importantly for cement and building material because, afterall, flyash is a half-cooked cement.

PROGRAMMES AND POLICIES

Ever since the country started to pay attention for environment in fall of 70s, the concern for flyash utilisation has gained importance.

The National Waste Management Council (NWMC) under the aegis of Union Ministry of Environment & Forests has dealt with the subject in different angles and issued several circulars to state governments and their respective electricity boards. The Report discusses the details of these circulars and the response of state governments at length.

Union Ministry of Power, as the flyash generator, has equally felt the concern. Two circulars dt 10.9.1991 and 10.1.1994 are prominent among them. But, the directions of the circulars have gone in tangent and no ice could be cut at the level of states' administration.

Wherever the flyash utilisation has taken off towards cement and/or asbestos sheets, exploitation has been started, charging the price for flyash or imposing heavy collection in the pretext of handling charges. Tamilnadu is one of the states notorious for this activity upon which press and judiciary have been sensitised.

Though government of Andhra Pradesh has initially allowed the state electricity board to have its own policies on flyash, of late, concern has been felt and incentives have been declared.

Government of Orissa, in its anxiety to promote flyash, has waived off sales tax not only on flyash products but also on the machinery meant for their production.

Government of Kerala has exempted sales tax on PPC in order to encourage its promotion.

On the part of Government of Punjab, a remarkable achievement is established with reference to Guru Gobind Singh Super Thermal Plant at Ropar where about 3.6 lakh tons of flyash is consumed only for the production of PPC. This could be made possible with the initiations taken by the government to offer land, concessional power and other fiscal incentives to two prominent cement companies. One of the longest ash conveying systems in Asia is installed at Ropar to a length of 1.6 km with the technology from M/s Macawber Beekay Ltd. Though the investment for this pneumatic conveying system is availed from the cement companies, this investment is reimburseable against supply of power, that too at concessional tariff. This exercise is a trend-setter to other state governments to show the will and commitment for flyash utilisation to comply with central government directions.

At central government level, the contemplations are in progress in different directions but without convergence to any target plan.

The basic drawback is the lack of inter-ministerial interaction. For example, the excise duty exemption given for flyash products in the Union Budget 1991-92 in the interest of promoting flyash utilisation is withdrawn in the Union Budget 1997-98 without having achieved the target for which the exemption was given.

Building Materials & Technology Promotion Council (BMTPC) has not touched the issue to the required dearth and thereby, their recommendations are lacking the required teeth receiving passivity at policy level.

The *Flyash Mission* set up by Union Ministry of Science & Technology has made the blunder of eliminating cement and building materials from its scope, resulting in lose of glamour to achieve any result worthy of claiming. According to its Chairman, Prof DV Singh, the building materials

have been incorporated in the objectives of the Mission now but, unfortunately, the Mission has only one more year of life to accomplish hardly any task.

But, Prof Singh, in his status as Vice Chairman, All India Council for Technical Education (AICTE) has recorded his willingness to include syllabus on cementitious byproducts and blended cements with reference to their role on advanced concrete technology. INSWAREB has taken up the task to submit a draft syllabus in consultation with Prof PK Mehta.

The Union Ministry of Industry does not seem to have realised the potentiality of PPC as evident in their doing little to promote the cause.

The Union Ministry of Urban Affairs & Employment seems to have formulated a Technical Committee and entrusted the promotion of flyash utilisation in their works to the Director General, Central Public Works Department (CPWD).

Central Electricity Authority (CEA) has made it a practice to give clearance to upcoming thermal plants only against a guarantee of 100% flyash utilisation over ten years of the commencement of the plant. The promoters are invariably yielding to this pressure and submitting ash utilisation schemes. But, the question remains whether the thermal plants could fulfil the commitment in the absence of awareness in the country about the efficacy of flyash as building material? On the other side of the coin, can the government enforce the closure of a thermal plant if the latter fails in the commitment of ash utilisation? The survey feels that either of the above dimensions are impossible to meet unless a cohesive action plan is resorted. In this background, CEA has been advised to take up various enlightenment programmes to propagate about the efficacy of flyash so as to strengthen the hands of thermal plants in promoting flyash utilisation, thereby, the imposed conditions by government would not prove null and void in the pretext of compelling grounds. In the present

power-famine condition of the country, no thermal plant can be forced to be closed. The solution lies in abating pollution through promotion of utilisation.

It is after seeing all this incohesiveness of coordination, INSWAREB has taken the initiative to conceive the *National Flyash Policy* (Annexure II), enlisting the accountabilities of government to accomplish the promotion. The Report encloses the gazette notifications of various governments and agencies together with the deliberations of NWMC and Flyash Mission in order to highlight the issue of compliments and complaints. Not satisfied with the response of government to *National Flyash Policy*, INSWAREB has initiated a Public Interest Litigation (PIL) at the Supreme Court.

Prof Mehta has taken an initiative to convince about 20 global experts on cement chemistry to come to India in order to impart necessary knowledge at faculty, industry and policy segments, in order to consolidate the efforts on promotion of flyash and other cementitious byproducts in India. Prof VM Malhotra, Program Manager, Advanced Concrete Technology Programme, Minerals & Metals Sector (CANMET), Canada who has done remarkable studies on flyash utilisation, both at lab and field level, is equally keen for this programme. INSWAREB is taking the lead to organise a policy level meeting at New Delhi. It is expected that the concerned Ministries, the Planning Commission, industry and the faculty of national institutes draw benefit of the experts' availability in India so that, by the end of the deliberations, a cohesive action plan could be drawn for effective implementation by government of India. This is the only way that mammoth tasks such as flyash utilisation at national level could be tackled to the due need.

ANNEXURES

LIST OF INTERVIEWEES**At government level :**

1. Prof Abid Hussain
Member of the *high level advisory board on sustainable development* established by the UN Secretary General
New Delhi
 2. Dr Ashok Mitra
Chairman
Department Related Parliamentary Standing Committee
on Industry
New Delhi
 3. Mr Santosh Mohan Dev
Chairman
Department Related Parliamentary Standing Committee on
Urban Affairs & Employment &
Rural Areas & Employment
New Delhi
 4. Dr EAS Sarma
Secretary
Union Ministry of Power
New Delhi
 5. Mr V Suresh
Chairman & Mg Director
Housing & Urban Development Corporation (HUDCO)
New Delhi
 6. Ms Adarsh Mishra
Commissioner and Principal Secretary
Department of Industries
Government of Delhi
Delhi
-

-
7. Prof DV Singh
Chairman,
Flyash Mission Technical Advisory Group (FAMTAG) &
Vice Chairman, All India Council for Technical
Education (AICTE)
New Delhi
 8. Mr KK Mishra
Adviser (Energy)
Planning Commission
New Delhi
 9. Mr A Rengaswamy
Chief Engineer (Thermal Civil Design Division)
Central Electricity Authority
New Delhi
 10. Dr (Ms) Saroj
Jt Director
Union Ministry of Environment & Forests
New Delhi
 11. Mr PB Vijay
Director General (Retd)
Central Public Works Department
New Delhi
 12. Mr SP Goyal,
Chief Engineer (O&M) /
Mr Sudarshan Bhandari,
Sr Executive Engineer
Guru Gobind Singh Super Thermal Plant
Ropar (Punjab)
-

13. Mr SP Gupta
ADC cum CEO
District Rural Development Agency (DRDA)
Panipat (Haryana)
 14. Mr B Danam
Secretary, Housing
Government of Andhra Pradesh
Hyderabad
 15. Mr J Parthasaradhy
Chairman
AP State Electricity Board
Hyderabad
-

At Industry Level :

1. Mr Nil R Chatterjee,
Asst General Manager/
Dr JK Moitra,
Sr Executive (Environment)
M/s Larsen & Toubro Ltd
New Delhi
 2. Mr Ajay Kumar
Mg Director
M/s Macawber Beekay Ltd
New Delhi
 3. Mr TC Arora
Contracts Manager
M/s Mitsui & Co Ltd
New Delhi
 4. Col Ranvir Singh (Retd)
M/s Drona FaL-G Bricks
New Delhi
 5. Mr MP Mittal
Asst Vice President
M/s Gujarat Ambuja Cements Ltd
P.O. Lodhimajara (Punjab)
 6. Mr OP Puranmalka
Sr President
M/s Indian Rayon & Industries Ltd (Cement Division)
Secunderabad
 7. Mr NPS Shinh
Mg Director
The Andhra Cements Ltd
Secunderabad
-

DRAFT ON

NATIONAL FLYASH POLICY

FOR

GOVERNMENT OF INDIA

PREPARED BY

**INSTITUTE FOR SOLID WASTE RESEARCH & ECOLOGICAL BALANCE
(INSWAREB)
VISAKHAPATNAM 530 012**

**MAY
1996**

NATIONAL FLYASH POLICY

I : INTRODUCTION

Flyash is the residue of coal combustion. When coal is totally burnt, the constituents of coal viz. principally the oxides of silica and alumina concise into fine ash. Some portion of this ash (about 20%) is overburnt beyond melting point and crystallises as granules which is identified as bottom ash. Balance 80% of the ash flies alongwith flue gases and gets entrapped into bag filter or electrostatic precipitators which is identified as flyash.

While coals of Western and Eastern countries contain 10-15% of ash, Indian coals are enriched with ash to the extent of 35 to 40%. However, by virtue of Indian fuel logistics, power plants are predominantly dependent on indigenous coal to the extent of about 70% of total power generation which invariably contribute to belch out millions of tons of flyash. With the promotion of more and more coal based thermal plants, the ash generation is getting multiplied geometrically as per the data below :

1971	...	12 million TPA
1981	...	25 million TPA
1991	...	40 million TPA
1996	...	65 million TPA
2000	...	120 million TPA (projected)

Needless to highlight that flyash is one of the worst pollutant of sub-soil and air which has already occupied several thousands of hectares of land, stretching farther and further with additional generation.

This unabated massive generation and accumulation of flyash has sent warning signals to everybody concerned summoning for urgent action plan for its effective and total utilisation.

However, the flyash of Indian coals, being deficient of lime constituent in comparison to Western and Eastern coals, is not attractively placed to find its way into cement in considerable quantity. For example, in the production of Portland Pozzolana Cement (PPC), while ashes of Western coals are added to the extent of 35-40% to Ordinary Portland Cement (OPC), the Indian ashes are not being added beyond 20%.

On the brick front, the prevalence of clay brick production in cottage and SSI segment holds the overheads and manufacturing costs to the minimum

whereas the flyash brick with multicore investment outlay and costly input of utilities like steam can not withstand the price competition.

The other avenue of flyash use as land fill incurs with cost of transportation from generating point to dumping point. In spite of provisions made in *Electricity (Supply) Act 1948* to charge some cost for disposal of residue of fuel combustion, the lack of earmarking disposal cost element for flyash to meet this transportation on one hand and the permission to dispose the ash in slurry form into nearby ash ponds on the other do not compel the thermal plants (ash generators) to pursue this user segment.

On account of these explanations, the flyash utilisation scenario offers a gloomy picture in India registering a consumption of about 2-3%, allowing the rest of the output to get accumulated.

It is on account of this alarming situation, this Policy on Flyash is drawn as a National programme towards a coordinated time bound action plan.

II : OBJECTIVES

As a scientist analyses, flyash is a half cooked cement with dormant strengths that can be tapped of its potentiality as the productive building material. It is only the conducive technological adoption that paves the way. The advent of high strength cements like 43 & 53 grade enhances the opportunities for more ash input and, in turn, increased utilisation on cement front.

On brick front, the advent of FaL-G technology with its down-to-earth technological features permits the production of flyash brick with competitive price logistics and superior technicalities over clay brick and thereby paves the way for use of 100% flyash generation. With this shift in scenario, it needs to streamline the administrative mechanism on flyash delivery and collection system lest the user segment is greatly exploited, countermanding the spirit of total flyash utilisation. It is in this context, this Policy document enlists the objectives as follows :

- To streamline the collection and delivery system of flyash in order to meet the requirements of the users without any hassles through :

- Fund management to finance the dry ash collection and delivery system at all thermal plants.
 - Administrative tone up at all flyash generating points to deliver the ash to the user without any exploitation and delays enacting necessary laws.
 - Imposing ban, through legislation, on the sale of flyash or collection of any money in whatsoever account for delivering the ash to prospective users.
- To tone up the funding mechanism for the promotion of flyash based industries in SSI and large industry accrediting these industries as priority sector.
 - To take up massive propaganda campaign for highlighting the technical supremacies of flyash based brick and cement over conventional competitives.
 - To enact necessary legislations from time to time to strengthen and streamline the generation and utilisation aspects of flyash by inducing the necessary synergy to minimise, if not phase out, the consumption of clay brick and OPC by supporting the production system of flyash based brick and cement in the direction of mineral conservation towards ecological welfare.
 - To impose ban on all filling activities with natural earthly materials within 200 km radius of existing ash ponds.

III : FLYASH UTILISATION

Flyash for cementitious blends :

There exist two IS Codes as follows :

- IS:1489- 1967 (Portland Pozzolana Cement)
- IS:3466 - 1988 (Masonry cement)

The Code on PPC was drafted in 1967 when the principal constituent i.e. OPC was prevailed to be 33 grade. However, with the production of 43 & 53 grades now and opportunities to produce even 63 grade in near future, the scope of blending more flyash is brightened up beyond the specifications of existing code. Even the revised Code IS:1489(Part I)-1991 does not take this

factor into cognisance. This Policy encourages the rationalisation of Code for PPC to open up opportunities for more flyash input.

With the spiralling cost of cement day after day, the opportunity to sell masonry cement with competitive price logistics is brightened up. However, it needs to ensure the industry with the availability of required grade of flyash which this Policy hopes to meet through promotion of dry ash collection and delivery system at all thermal plants.

The distress of concrete is a subject of concern worldwide on account of continued reactivity of OPC, more so because of the escalation of pollutant factors in present industrial environment. It is also established that PPC is a dependable cement to combat the effect of distress of concrete. This Policy envisages to draw a massive mass media propaganda to highlight these technical virtues for the benefit of the user segment so as to create more and more consumer oriented demand for PPC.

It also attracts the cement industry whose capacity increases to the extent of flyash input without much additional capital.

Flyash for brick and block :

With more and more constructions, the fields in and around each urban growth centre got barren on account of profuse production activity of clay brick leading to erode the fertile soils in the vicinity. In consequence, the quality of brick is greatly deteriorated for having used the inferior grade clays.

The fuel, firewood or coal, is one of the principal inputs in the production of clay brick. With the heading of civilisation towards fuel famine scenario, the cost of fuels are skyrocketing day after day and the concern for their rationalisation is gaining importance to contain the ultimate costs. This is resulting in improper sintering of clay brick which is adding to the factor of deterioration in quality through poor grade soils.

In the background of the above points, the Indian brick, which was popular with strengths of 200-300 kg/sq cm once upon a time, is being produced with only 20-50 kg/sq cm in most parts of Southern India and 100-150 kg/sq cm where potential silts are available. In contrast to these strengths, FaL-G technology has established manufacturing flyash bricks with wide range of strengths from 80 to 300 kg/sq cm through scope of manoeuvrability in process parameters. The ease of production is established even at cottage industry level. Even in mechanisation, the need of investment ranges from Rs 2 to 4 lakhs for an output of about 6000 bricks/shift.

Avoidance of energy is the remarkable feature of this technology. In result, in many parts of the country, where this technology is already adopted, FaL-G bricks are proved to be superior in technicalities and competitive in marketing price in comparison to clay brick. This has enthused many clay brick manufacturers to shift over to FaL-G brick and this Policy envisages to encash upon this situation to promote mass scale flyash utilisation.

According to one study, notwithstanding the rural market, if FaL-G brick penetrates into the 120 billion brick consumption in urban sector, which is feasible on account of techno-economic logistics, a consumption of 60 million tons of flyash can be established in brick segment alone. But, it needs an orchestrated coordination and back up from the Government to encourage this segment for which this Policy envisages the following :

- To promote *Flyash Depots* at all urban growth centres to give easy access to SSI and cottage entrepreneurs for drawing the required quantity of flyash.
- To ban whatsoever trading on flyash in order to elate confidence in SSI entrepreneurs about hassle-free flyash availability to enthuse them to go for more and more flyash based brick industries.
- To establish industrial parks at all urban growth centres within 200 km radius of flyash generation with all infrastructural support to house the brick plants in clusters.
- To insist upon the use of flyash bricks in all Government oriented constructions.

Flyash for landfill and roadfill :

The cost of gravel or earthly materials are increasing day after day making the landfill a costly activity. The erosion of hillocks is an added dimension causing irreparable damage to ecology. When flyash is offered for such purposes, with relatively better engineering properties, there appears no reason why it should not be used. No doubt, the economic logistics determine the scope. To make the land fillings with flyash as more feasible, this Policy envisages to earmark certain fund, collected through the imposition of cess for flyash disposal. However, ash for such purposes would be drawn from the existing ash ponds by which a steady and constant offtake can be established from these ponds.

IV : FLYASH COLLECTION AND DELIVERY SYSTEM

Realising the need of dry flyash as a potential raw material for building material industry, the Union Ministry of Power (MOP) has issued two Circulars dt 10.9.1991 and 10.1.1994 directing all thermal plants in private, State and Central Government Sector to instal dry ash collection system. But none of the plants have complied with this directive except a handful of plants that can be counted on fingers. It involves a per capita plant cost of about Rs 1500 per ton for dry ash collection system. Most of the thermal plants calculated these costs on their respective total flyash generation, landing into several hundreds of crores of investment outlay that has discouraged serious efforts in this direction.

The consumption of flyash for brick and cement has been not streamlined by the government, producer or the user for lack of proper linkage and thereby offering no registered consumers in considerable number to any thermal plant in order to enthuse the latter to go for installation of dry flyash collection and delivery system.

No incentives are available to thermal plants or built-in the cost of power to promote the utilisation of flyash. The Electricity (Supply) Act, 1948 clearly specifies: *"Cost of fuel" means the sums expended for fuel consumed plus the costs of any transport, handing, preparation or treatment incurred in connection with the delivery of fuel to the boiler hoppers, furnaces or engines and in connection with the disposal of the products or residues of combustion.* Now, the time has come to impose a cess based on the provisions of this Act to generate separate fund for collection and distribution of flyash..

In this background, it is preferred to incur the cost of Rs 80 to 120 per ton of ash for its disposal in slurry form rather than diverting this expenditure for delivery of dry flyash to prospective users.

To tackle all these issues in an effective and pragmatic manner, this Policy draws the following guidelines :

- The Government wants to generate sizeable fund to promote ash utilisation partly by imposing cess on every unit of power generated/consumed and partly by saving from the slurry pumping budget.
- The Government owns the massive propaganda campaign to create consumers' awareness on the virtues of flyash based building material, in turn, to enthuse the manufacturers to set up more and more industries.

- Each thermal plant would be funded by Central Government to instal the minimum capacity of dry ash collection system in order to elate confidence on the user segment about the availability of dry flyash.
- The Policy envisages to offer necessary fiscal incentives to the organisers of Flyash Depots at each urban growth centre within 200 km radius of flyash generation to enable easy access to all prospective users of flyash.
- The Policy envisages to enact a legislation banning collection of any charge in whatsoever cause by the flyash generators for delivering the ash to the prospective users in order to elate confidence in industrial circles about the sustained availability of ash, to inspire confidence to promote more and more flyash based industries.
- The upcoming thermal plants should concentrate on *zero* accumulation of ash, drawing action plans for initiating production of brick and PPC right from day one of ash generation. Necessary infrastructure and investment outlay should be the concurrent exercise alongwith that of thermal plant.

V : SUPPORT MECHANISM FOR FLYASH UTILISATION

- This Policy envisages to impose a cess of Rs 0.02 per every unit of power generated and utilise the same fund for the installation of dry ash collection as well as offer as transport cost to the depot operators. At the projected output of 400 billion units in 1996-97, this cess works out to be Rs 5.6 billion, considering 70% as coal based thermal operation.
- This Policy envisages to waive off excise duty on PPC or establish a clear gulf of excise duty between PPC and OPC whereby the cost of PPC comes down by Rs 25 per bag, on account of disparity on excise tariff alone, so that such price difference enthuses the consumer to opt for PPC. To make the price of PPC more attractive, the cement plants would be directed to pass on the savings, on account of substituting a portion of clinker (costing about Rs 1200-1400 per ton) with no-cost flyash, to the consumers.
- This Policy envisages to waive off all duties and taxes on flyash brick industry in order to encourage mushroom like cluster promotion by SSI and cottage industrial segment.
- This Policy directs all the financial institutions to accord funding on priority basis for PPC plants in large scale segment and flyash brick plants in SSI segment, if possible with concessional interest rates. Due

accountability would be conferred on Industrial Development Bank of India (IDBI) and Small Industries Development Bank of India (SIDBI) with periodical review meetings on progress of industrial funding for flyash based industries.

- Lime and gypsum being two principal inputs for FaL-G brick plants, this Policy recommends all fiscal reliefs to these processing industries in order to encourage synergy in raw material availability.
- A high powered Working Group would be constituted with faculty of civil engineering, the consumers of building material in the Government i.e. Central Public Works Department (CPWD), Housing & Urban Development Corporation (HUDCO), Ministry of Surface Transport, Ministry of Rural Areas & Employment, Housing Corporations etc in order to evolve strategies and coordinated action plan for the promotion of PPC and flyash bricks in all Government constructions as well as to review the progress from time to time. They would also recommend the inputs for codal specifications and their updating.

VI : GOALS

- To establish demand of PPC not less than 50% of total cement consumption by 2000 A.D. where the latter is expected to register about 113 million tons.
- To promote 10,000 FaL-G brick plants, each with a capacity of not less than 6000 bricks per shift with an aggregate output of 18 billion bricks per annum on single shift basis that can consume 9 million tons of flyash.
- To achieve zero accumulation of flyash by 2010 A.D., with no quantity to be added to the existing ash ponds.
- To deplete by 2010 A.D. 50% of the existing accumulation in the ash pond towards all filling activities.

INVESTMENT OPPORTUNITY IN EVERY SEGMENT OF FLYASH ACTIVITY : ROLE OF GOVERNMENT

